

ABSTRACT OF THE DISCLOSURE

A low CTE metal-ceramic composite material featuring carbon fibers reinforcing a matrix featuring silicon metal or silicon alloy. The fibers have a low coefficient of thermal expansion (CTE) in the axial direction, and preferably negative. The principles of making Si/SiC composites can be adapted to produce the instant Si matrix composites. The CTE of the composite body depends not only upon the relative CTE's of the fibers and matrix, and their relative amounts (e.g., loadings), but also upon the relative elastic moduli of the fibers and matrix. Thus, Si/SiC matrices produced by a reaction-bonding process inherently possess low CTE, but the instant inventors prefer to make such composites having relatively large fractions of unreacted silicon, thereby driving composite CTE lower still. Here, the carbon fibers are protected from reaction with the silicon infiltrant with one or more materials disposed between the fibers and the infiltrant. Providing at least a degree of toughness or impact resistance can also be realized in these composites. Laminates produce isotropic or quasi-isotropic properties in the composite body can be realized by, for example, providing the fibers in the form of cross-ply laminates featuring the fibers in parallel or woven arrays.